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DEVELOPMENT OF SOVIET ARTIFICIAL CORUNDUM RESEARCH AND PRODUCTION

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Precious stones are finding unlimited application in science and technology. Modern instrument construction, the aviation, electrotechnical, and other branches of the national economy could not possibly function without the use of crystals.

Expanding socialist industry has placed before Soviet scientists the problems of organizing the mass production of artificial precious stones, lowering their cost, and meeting the industrial demand for gem corundum. The production of artificial gems requires laboratory duplication of the conditions surrounding the crystallization of gem stones in nature, and such conditions are not easily simulated. However, the production of synthetic corundum was mastered.

In 1932, S. K. Popov, chief of the Laboratory of Corundum Synthesis in the Institute of Crystallography, Academy of Sciences USSR, began working on an apparatus for the plant-scale production of precious stones. The apparatus which he proposed was successful and the production of corundum was turned over to industry.

The artificial ruby cannot be distinguished from the natural ruby. Both consist of aluminum oxide. The conversion of aluminum oxide into ruby is a complex process. Chemically pure aluminum oxide in a fine powder of grain size not exceeding one to 2 microns is fed in a thin continuous stream into an oxhydrogen gas flame burning at over 2,000°. The powder fuses and very fine droplets settle on a special high-melting ceramic candle. In the beginning, a cone of fine crystals is formed on the tip of the candle. One of these becomes the base of the crystal. The growing crystal is pear-shaped. This crystal is the artificial gem corundum. The color of the crystal may be varied by the addition of various metal oxides.

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Artificial corundum is second in hardness only to the diamond, and only diamond dust can be used to process it. However, as the crystal is sawed into pieces of the desired shape and ground, 90% of the artificial precious stone goes to waste.

Soviet scientists and engineers were called upon to devise ways and means of reducing the expenditure of diamond and corundum in sawing and grinding and to find crystals of a more workable form.

Popov, under the supervision of the institute's director, A. V. Shubnikov, Corresponding Member of the Academy of Sciences USSR, developed, and, along with engineers of the Chernorechensk Chemical Plant, V. V. Svyatukhin and A. I. Rukavishnikov, introduced a new-type apparatus into production. In the history of the production of artificial corundum, Soviet scientists and engineers were the first to create an apparatus which made it possible to prepare crystals of gem corundum in the form of rods, offering fine, ready-made semifinished material for technical stones.

In this apparatus, the aluminum oxide powder is fed at a determined rate and in a rigidly controlled quantity. An automatic stand was built to allow control of the growth of the corundum. New solutions were found for the problem of gas feed, uniform heating of the growing crystal, etc. The surface of growth of the crystal was successfully reduced in the new apparatus by 50 to 60 times, and its linear rate of growth was increased 10 to 15 times. The apparatus permits the growth of a crystal with a diameter of 2 to 3 mm.

For developing the apparatus and production technology of red corundum, Shubnikov, Popov, Svyatukhin, and Rukavishnikov have this year been awarded the Stalin Prize.

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